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CONTENTS

BIOTECHNOLOGY

DUTCH GENETIC ENGINEERS WORK ON PLANT BREEDING

Amsterdam ELSEVIERS WEEKBLAD in Dutch 5 Jun 82 p 9

[Article by Joop Berger]

[Text] The tomato plant is a self-fertilizer. Plant improvers find that annoying because that makes it difficult for them to cross-breed different tomato varieties. The petunia and genetic engineering may perhaps provide a result.

Although the use of concepts such as superplants appears premature, it is, indeed, clear that those who tinker with heredity have found fertile soil also in agriculture. Trade and industry appear very interested.

Enterprising financiers have lately shown a growing interest in a new, interesting investment object: plant biotechnology. In the United States, brand-new enterprises are able to attract much money for research aimed at the manipulation of hereditary properties in cultivated plants. Prospects of spectacular products are, indeed, also held out, such as the tomato-'pomato' and the 'sunbean.' The tomato-'pomato' would be a superior potato in which a few properties of the tomato have been incorporated. These properties of the tomato plant would make the potato plant insusceptible to certain diseases. When the sunbean is, indeed, introduced on the market, the growers will have at their disposal a plant which possesses the combined properties of the sunflower and the white bean. The hereditary substance (DNA) of the sunflower takes care of the production of oil and protein, the DNA of the white bean stimulates the making of extra protein.

Also the established food industry takes an increasing interest in the possibilities of genetic engineering in respect of plants. The U.S. giant soup manufacturer, the Campbell Soup Company, recently invested 10 million dollars in a project which, among other things, is expected to furnish a tomato plant with genes of the tobacco plant. In the United States and in Western Europe, a number of universities and government institutions are busy improving cultivated plants at a genetic level. They have mainly arrived at this along the road of basic research into the heredity of plants and the working of the plant cell.

Also the Netherlands belongs to this group. In Wageningen, Professor, Dr. B. de Groot of the ITAL Foundation, together with 9 scientific coworkers, will before

long start a research program which is expected eventually to result in an improved version of the 'bintje' [a potato variety; translator]. This economically important potato variety may, for the time being, be brought to good production only by means of an extended spraying program. Some potato varieties are by nature resistant to the diseases against which the 'bintje' has to be protected by means of costly pesticides. The researchers of ITAL will attempt to transfer to the 'bintje' the pieces of DNA which in these varieties provide the resistance to diseases.

In Wageningen, a group of biochemists, under the leadership of Professor, Dr. R. A. Schilperoort, are examining the possibility of incorporating in plants the ability to form nitrogen compounds. Such plants would need less or no nitrogen fertilizers for their growth.

The Department of Genetics at the Free University of Amsterdam is going to carry out a project in cooperation with the Institute of Plant Improvement at Wageningen which is expected to provide an improved tomato variety.

Selective

The adaptation of plants to the desires of man is nothing new today. Already for thousands of years, man has been trying, through selection, to grow plant varieties with new favorable properties. During the last 150 years this has taken place through selective hybridization. Not a single cultivated plant, therefore, is still identical to its remote ancestors. The species of wheat now standing in fields differ enormously from the original wild wheat. Their yield, for example, is twenty times as high.

Impressive results have been attained by means of the classical methods of plant improvement. These methods, however, have their limitations. Through cross-breeding, only variants of the same species or of related species may be combined. Through newly developed techniques from the laboratories of molecular biologists and biochemists, the possibilities of combinations may now be considerably widened. One of these techniques is the so-called fusion of protoplasts.

Protoplasts are cells which have become removed from their cell wall. When the cell wall is dissolved, an insurmountable barrier disappears, and the cells of two different plant species may become fused. Thereby, the genetic substance of both cell nuclei also becomes mixed. The cooperating researchers of the Department of Genetics of the Free University of Amsterdam and of the Institute of Plant Improvement will be making use of this technique.

Dual Purpose

Professor, Dr. H. J. J. Nijkamp of the Department of Genetics: "Our research has a dual purpose. In the first place, we want to increase our knowledge of a quality which occurs in a few plant species and which is called male sterility. In the second place, we shall try to incorporate this property of male sterility into the tomato plant which does not possess this property by nature."

"The existing commercial tomato varieties are all hybrids: varieties arise from the cross-breeding of existing varieties, the favorable properties of which one has combined. However, such hybridization between different tomato varieties does not take place spontaneously. The tomato plant is a plant which fertilizes itself. The stamen of the tomato plant produce pollen which end up on the pistil of the same plant and there lead to seed-formation. In that way, a combination of desired genetic properties of different varieties cannot take place. In order to cross-breed a tomato variety with another variety, one could remove the stamen from one of the two varieties. That may be done in the case of a few plants, but in the case of an entire field, this would be much too labor-intensive. It, therefore, would be extremely nice if we could make the male stamen of that tomato plant infertile or sterile, so that non self-fertilization takes place."

"We shall now try this by means of the petunia. This ornamental plant possesses by nature the property of male sterility, and that property probably lies in the mitochondria, small organs in the plant cell. By means of protoplast fusion, we shall try to fuse the cells of the tomato plant with those of the petunia, so that tomato cells with petunia mitochondria arise. In special soils, we shall then grow the cells into tomato plants. We then hope that the plants will carry the property of male sterility in their genetic structure."

Resistance

The fusion of tomato and petunia protoplasts should in this study thus provide a tomato variety which has lost its ability of fertilization and thereby, of itself, switches to cross-pollination. Protoplast fusion is also used to protect plants against diseases. That happens in the research program in which the Campbell Soup Company has invested $10 million. For its cans of soup, Campbell has got enormous fields of tomato plants in California. In order to keep these plants free of diseases, the company spends much money on pesticides. A tomato variety with a built-in disease resistance would be extremely attractive from an economic point of view. That is why researchers at Campbell try to transfer the natural disease resistance which is present in the tobacco plant to the tomato plant by means of protoplast fusion.

In theory, the new biotechnological methods make it possible to develop plants which are resistant to diseases, which thrive in a soil with a high salt content, or which are content with poor soil and a dry climate. It also appears possible to stimulate plants to produce the same yields at lower temperatures. That would result in considerable energy savings in greenhouses. The expectations, therefore, are also high, in the food industry as well as in scientific circles. That has led, among other things, to enthusiastic reports in the press on a possible definitive solution to the world food problem thanks to the new "superplants." Will genetic engineering manage to come up to these high expectations or will vast disillusionment follow shortly?

The possibilities of biotechnology are not unlimited. The less related the plants are of which one wants to combine the genetic substance, the greater is the chance that the hereditary mass of the different species will not tolerate each other.

Rejection may take place, as also happens in the case of transplantation of human organs. But even when, for example, a protoplast fusion has been achieved, numerous obstacles still remain to be overcome. Finally, there is, moreover, the time-consuming process of testing in the field or in the greenhouse. A plant which is a success in the laboratory may be a total failure in the field.

On account of all the problems associated with plant improvement by means of genetic engineering, many Dutch researchers assume a somewhat cautious attitude when asked about the possible future applications. In any case, more cautious than some foreign colleagues who already see commercial applications within a few years. A combination of the complete hereditary material from two totally different plant species is, according to the Dutch researchers, only interesting to basic research. It will never provide anything really useful. However, they do believe that the transfer of a few properties from one plant to the other in the course of 10 to 15 years may lead to new commercial cultivated plants.

Professor Nijkamp: "Among the classical plant improvers, you will find critics who do not believe in the new developments. If they find that there is still a lot of work to be done, then they are, of course, right. If they say that the expectations are rather high, then they probably are right as well. The molecular biologist is often somewhat overly enthusiastic about the developments in the area of genetic engineering. He actually then forgets that classical plant improvement has been enormously important and will remain so also in the future."

Supplement

"We must view the new methods in the area of tinkering with heredity as an interesting and important supplement to developments which have already taken place in the area of plant improvement," says Nijkamp. He points out, on the other hand, that we must not be so critical with regard to the possibilities which molecular biology offers that we retard developments.

"Everything in this area goes somewhat slowly," says Nijkamp. "Everything, so far, happens on a too small scale and in ad hoc cooperative arrangements. However, one seems to become awake also in this area. Recently, a report appeared from the Biotechnology Program Commission. That report also clearly embraces plant biotechnology. There is also an increasing cooperation among the classical plant improvers and the molecular biologists via the Agricultural Genetic Engineering Commission. I hope that this tendency will continue. The Netherlands has always had a good name in the area of agriculture. In order not to lose our leading position, we must, at least, keep up with the new developments."

7262
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FRENCH EFFORT IN BIOTECHNOLOGY INCREASING

Paris LE FIGARO in French 26 Oct 81 p 16

[Article by Jean Baudot]

[Text] Toulouse--Following the craze of leading American companies over industrial applications of "genetic tinkering," the French industrial world has also launched out on this future path with the establishment of Transgene and Genetika.

The international conference held in Toulouse from 20 to 22 October made it possible to assess the future of such applications in France.

In a speech delivered at the start of the conference, Mr Jean-Pierre Chevenement, minister for research and industry, outlined the major features of the new administration's policy in this regard: increased financing, the establishment of its own or associated laboratories, higher quotas of engineers. Moreover, the minister seemed to want to modify the criteria for judging the work of research teams, in which case consideration will be given preferentially to the number of licenses granted to industry and no longer just to the quality of scientific publications.

A New Calling for Regions

The industrial world involved in biotechnological programs (ELF [Gasoline and Lubricants Company of France]-Aquitaine, Rhone Poulenc, Institut Merieux ...) has also been able to compare with research officials (Pasteur Institute, National Institute of Applied Sciences ...) different views on the most interesting areas of research: inhibitory enzymes, hybridomes, all-inclusive research on new properties (screening), synthetic vaccines.

It was not by chance that such a conference was held in Toulouse. The Midi-Pyrenees metropolis, which has a great potential for research and training in microbiology and cellular genetics, is actually seeing a new calling emerging for it with biotechnology, after aeronautics, space technology and electronics. One of four centers for the transfer of French biotechnology will open next year, intended to bring together researchers and industrialists for developing and perfecting new production processes. Toulouse has also been selected by Bio-Elf as the site for its first European biotechnology laboratory, where

70 researchers will be employed starting in 1983, conducting research on seed improvement in particular.

It is also in this region that an exemplary "biotechnological PMI" [small and medium-size industries] (Setric) has been developed, working in the areas of both organism production and training materials and whose success has led two "giants" (ELF-Aquitaine and Moet-Hennessy) to acquire stock in subsidiaries.

11915
CSO: 3102/304

'BIOTECHNOLOGY MISSION' TO COORDINATE FRENCH RESEARCH, DEVELOPMENT

Paris LE MONDE in French 28 Oct 81 p 12

[Article by Maurice Arvonny]

> [Text] One of the first decisions by the minister for research and technology, Mr Jean-Pierre Chevenement, was to create six missions covering research sectors in which he considered urgent action was necessary. The first to begin operating is the biotechnology mission, whose chairmanship has been assigned to Mr Pierre Douzou. A member of the Institute and an expert in low-temperature biology, Mr Douzou has also been life sciences director for the General Delegation for Scientific and Technical Research (DGRST) and was thus already involved in the sector covered by the mission.

How is this mission organized? What are its structures? What will its program be? For the time being, Mr Douzou has set up a light structure; three sectoral officials, Messrs Philippe Kourilsky, Gilbert Durand and Gerard Siclet, are respectively in charge of basic research, transfer research and bioindustrial research. They rely on the advice of a committee of 11 experts who simultaneously represent all research centers and all disciplines involved. The commmittee has already met twice and its role is to coordinate and evaluate the research. Correspondents also provide links with different ministries, so that research policy can be adapted to the strategies of ministerial departments. A national biotechnology committee, chaired by the minister for research and technology, should be established early next year; it will determine the strategy to be followed in the area of biotechnology, with the mission then becoming its secular arm.

The mission has so far been concerned with learning more about the state of research and especially its consistency. French researchers have their strong points, such as genetic engineering, with good university and other laboratories and development centers such as the G3 group and the Transgene company. The situation is not bad either in the case of biochemical engineering (Compiegne, Toulouse) and vegetable cell cultures, in which the National Institute for Agricultural Research has made a serious effort. But the big "hole" is microbiology. The potential which existed several years ago has vanished, since laboratories did not receive critical funding and there is a striking lack of

microbiological stock. Mr Douzou is amazed that France, which is the country of Pasteur and systematics, has so neglected the systematics of microorganisms: The number of recorded species is in the thousands, while nearly a million insect species are known.

And microbiology is the source of all the rest: It is absolutely necessary to acquire a better knowledge of microorganisms, particularly hardy bacteria which proliferate in nature and whose potential could be broadly exploited. In a veritable "praise of putrefaction," Mr Douzou noted that "the layer of dead leaves covering the forest floor in November has disappeared by February. Microorganisms have digested and eliminated it. No one knows exactly what has happened or what products have been synthesized, but some of them could be very useful. Similarly, when a beam rots, it is microorganisms which have transformed the wood. What did they do? An industrial society concentrates and transforms all kinds of materials whose by-products threaten the biosphere: There are definitely microorganisms capable of eliminating them or even improving them." A first priority is to study these decomposition processes, in which thousands of molecules are synthesized, especially since, with the culture medium being wastes, only a single valuable product need be synthesized for such biosynthesis to be economically attractive.

Assuring the consistency of research and "plugging the holes" is one of the primary goals of the mission. Another is the transfer of technology and basic research to industry. This is the reason for the 3-sector division mentioned above. Three transfer centers exist or are in the process of being opened at Compiegne, Toulouse and the Pasteur Institute. They will be the meeting places for researchers, engineers and industrialists. Mr Douzou would like for them to act as a stimulus, although he admits that this will not be easy. Transfer of technology has always been the weak point of French research, which has "a great reservoir of knowledge, but not always of know-how." In the area of biotechnology, the problem is paradoxically heightened by the existence of well-established processes: Wines and cheeses are made according to age-old technology, which serves as a pretext for not conducting research. But, as Mr Douzou noted, "the specificity of French wines depends on the microorganisms proliferating in the casks; anyone can purchase some casks, study the microorganisms and perhaps within a few years, reconstitute equivalent wines." It should be quite apparent that the entire food-agricultural sector could be disrupted without warning as a result of future biotechnological advances. Thus it is important to increase the awareness of producers.

Two other industrial sectors, fine chemicals and pharmaceuticals, which mainly use nonbiological synthesizing processes, could also have their methods disrupted in a few years.

Basic research, the holder of the unforeseeable, must also be broadened. "Ten years ago, no one foresaw the emergence of genetic engineering, which resulted from research that seemed to be of marginal importance," Mr Douzou noted. At the same time that acquired knowledge is being transferred, research must be conducted elsewhere. Finding enzymes that withstand high temperatures--most are destroyed at 40° C.--could have consequences of very great industrial importance.

BRIEFS

OFFICIAL EUROPEAN POSITION ON DNA--Following a detailed analysis, the Economic and Social Committee [CES] of the European Communities adopted, during the plenary session of 15-16 December 1981, its definitive position concerning studies on recombinant deoxyribonucleic acid (DNA). The risks associated with recombinant DNA studies are today considered minor. But the CES believes that it is essential to continue to emphasize risk-evaluation studies; to provide training in microbiological safety; to maintain safety standards to reassure the public; to coordinate current arrangements in member countries in order to simultaneously guarantee fair competition and equal safety conditions. The committee concluded that in the case of genetic research, the European legal instrument for covering such objectives should take the form of a directive. In accordance with the views expressed by national experts during the conference, the committee believes that European directives concerning studies involving the use of pathogens (microorganisms causing illness) should be established. With regard to certain concerns expressed by the public concerning genetic research studies going beyond the area of recombinant DNA, the committee said that it was in favor of an international initiative covering and specifying the moral aspects of genetic technology research. [Text] [Cergy BIO-LA LETTRE DES BIOTECHNOLOGIES in French Jan 82 p 6] 11915

CSO: 3102/304

RIBER TO COMMERCIALIZE FIRST MBE SYSTEM FOR SILICON

Paris ELECTRONIQUE ACTUALITES in French 30 Apr 82 pp 1, 17

[Article by J.-P. Della Mussia]

[Text] Before the end of the year, the French company Riber, which is presently believed to cover approximately 65 percent of the world market for molecular beam epitaxy (MBE) machines, will offer the first commercial development machine of this type specially adapted for silicon.

This laboratory machine, whose specifications have not yet been disclosed, will make it possible to produce silicon components with unparalleled epitaxial precision, and do it at a low temperature (and hence with high production yields). It will also make it possible to create new types of integrated components, and in time, three-dimensional ones. Since 1976, Riber has sold 60 laboratory MBE machines, used for II, VI, or III-V materials, whose epitaxy problems are particularly delicate. In particular, 25 of the company's last MBE 2300 P machines, introduced in 1980, have been sold, mostly in the United States, but also in Japan, where Riber is believed to cover 80 percent of the market.

Starting With Ultra-High Vacuum

Riber has specialized in ultra-high vacuum (up to 1.10-11 torr) for some 15 years; it then developed its activities in all aspects of ultra-high vacuum, particularly gas analyzers, and then in Auger spectrometry and ion microprobes. The MBE activity began in 1976, unexpectedly, following the request from a German firm for an ultra-high vacuum system together with an Auger spectrometer and the capability to evaporate elements. Without knowing it, Riber at that time had all the facilities for making an MBE machine. The company immediately seized the opportunity, and marketed its first system in 1976. The activity acquired some magnitude in 1978, as a result of modifications made to the original system (in particular thanks to Bell Labs comments). The generation for 2- and 3-inch slices (MBE 2300) was introduced in 1980. Today, Riber has become the first in the world, ahead of Varian, Vacuum Generators, and Perkin Elmer. The MBE activity, which grew by 250 percent in 1981 for the company, now represents 48 percent of its total turnover, with 65 percent of the MBE turnover being obtained from exportations. (The actual turnover figure is not disclosed, but in 1981 the company sold 25 MBE machines at a price between one and two million francs). This growth has in fact compelled the company to recently move to Rueil Malmaison.

Toward Industrial Machines

So far, MBE machines remain laboratory (or small batch) models as a result of their output: maximum epitaxial growth rates are of the order of 10 microns/hour per slice. (For instance, an epitaxial layer of 1.2 microns is necessary for an FET, and a 5-6 micron one for a laser). But in practice, all the handling steps in FET production for instance, result in a production limited to three 3-inch wafers in 10 hours (with a machine maintenance every two weeks). A 3-inch wafer, however, can carry 10,000 and more GaAs transistors.

In addition to this capability, the MBE has exceptional features. This is the machine which allowed Bell Labs to obtain the "world's best crystal," with less than 1 percent variation in uniformity, doping, and thickness at the same time. This is also the machine which made it possible to fabricate super-networks, which today are almost certain to supplant Josephson devices in fifth generation computers. And finally, the MBE machine makes it possible to conceive any device structure, even in three dimensions.

Two methods currently exist for industrial epitaxy: liquid phase and vapor phase (CVD, or in the modern version, MO/CVD under partial pressure). The first method consists of flowing a liquid over the surface on which an epitaxial layer is to be grown, and lowering the temperature. But it works only over an area of a few square centimeters, does not result in good thickness uniformity, and precludes very thin deposits. It is nevertheless used in laser fabrication because it leads to good performances. Its low cost is compensated by the need to work in clean rooms.

Vapor phase epitaxy uses the decomposition of organometallic gases in a controlled atmosphere. It produces good results, and the technology is familiar. In particular, it does not require ultra-high vacuum. But the basic materials, which have poor storage characteristics, are made only in the United States for GaAs, and are expensive. Neither very thin layers nor selective epitaxy can be obtained with this method.

MBE, on the other hand, uses selective evaporation in ultra-high vacuum from several heated crucibles containing the materials to be incorporated in the deposited layer. The temperature of the substrate determines the crystallization. The crystallographic structure can thus be monitored during growth, and the dopant concentrations can be very precise since they are controlled by the crucible temperature. In addition, very complex structures can thus be created: a shutter, for instance, can instantly stop the doping, and any concentration profile can thus be obtained. That is why some have said that "the only limit for MBE is the imagination of the researchers."

We might also add that this method is the one which allows the use of the lowest substrate temperatures, and therefore the best fabrication yields.

Riber is now specializing in this advanced technology; a collaboration with Thomson-CSF's LCR, particularly as part of DRET contracts, has enabled it to perfect the characteristics of the various machines.

(The concrete success of such DRET laboratory/industry joint actions should in fact be emphasized).

So far, Hitachi and IBM are making the best industrial use of MBE, but Bell Labs are conducting the most advanced research.

Riber is presently attempting to define the future needs for an industrial MBE machine which would be marketed around 1983-1984.

Great Hopes for Silicon

MBE is also a great hope for silicon epitaxy because of the control it allows over thickness, doping, and crystallography. Research in this area has been conducted for 4-5 years. Riber has already begun to modify its machines for this purpose, and in fact has supplied a non-standard installation to IBM. Bell Labs has been working actively on this topic, and CNET (National Center for Telecms Studies) in Grenoble has just begun. An industrial outlet could be created when a machine with a capability of the order of 10 slices/hour makes its appearance, an event which will undoubtedly require at least another 2-3 years.

CAPTION:

This epitaxy machine, with some modifications, will probably make it possible to achieve the first three-dimensional integrated circuits in coming months. It is made by Riber in France.

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BUDGET, ACTIVITIES, FUTURE OF INRIA OUTLINED

Paris ZERO UN INFORMATIQUE HEBDO in French 26 Apr 82 p 17

[Article by Jean-Louis Cousin]

[Text] After some problems in getting started in 1980, the INRIA [National Information and Automation Research Institute] has managed to shift into second gear in 1981, when, during the second quarter, it got a very welcome budget bonus. This advance should continue this year, considering the government's ambitions in both electronics and research. The company's 1981 report does mention, among other points, the acceleration of its installation on new sites, an increase in personnel, and the status of its pilot projects.

The INRIA was created in early 1981, because of a desire to break apart and decentralize the former IRIA [Information and Automation Research Institute]. By early 1983, it will have three centers: Rocquencourt in the Paris region, Rennes, now being completed (both of these are already operational), in addition to Sophia Antipolis on the Valbonne plateau near Antibes. This center is now under construction. On 16 June 1981 an administrative decision allocated 17 million francs to this facility.

The total 1981 budget amounted to about 123.6 million francs (compared with 75.5 million francs coming from the IRIA in 1980). 17 new jobs have been created, bringing the staffing level up to 381 jobs. 28 additional jobs are to be created during 1982.

In terms of equipment, at the end of December the CII-HB [International Information Company-Honeywell-Bull] DPS Multics system was expanded to three central units (16 Mo) linked to 282 terminals. The system was first put in in 1980.

To handle communications between projects and services, no matter where they may be located, the Multics system is to be integrated with the DSA design of the CII-HB system, and interconnected with local networks which are gradually to be set up in the centers.

Pilot Projects

The INRIA has responsibility for four types of missions:

a) To undertake basic and applied research;

b) To develop experimental systems, associating as closely as possible both the public and private sectors;

c) To organize international scientific exchanges; and

d) To ensure the transfer and dissemination of knowledge and knowhow on a nationwide scale, by means of training and information.

In the area of research, particularly significant efforts have been made in robotics. There is a real workshop which should become operational in 1982, established with the assistance of the ADI [Data Processing Agency]. Several types of sensors are being tested as part of the ARA [Advanced Automation and Robotics] project.

Another noteworthy effort concerns the CAO [Computer-Aided Design] of highly complex VLSI [Very Large-Scale Integration] circuits. The studies being done in conjunction with Thomson, CIT, ALCATEL, SAGEM [Company for General Applications of Electricity and Mechanics], and CII-HB cover both the design of these circuits and the development of software systems.

The report also discusses the status of four pilot projects, for which the INRIA is either the sole contractor, or is working in association with other organizations.

1. SOL. This project covers the development of a standard base software system for French-manufactured mini and microcomputers.

The complete specifications for the SOL system have been determined. It is to be used on three machines: the Mitra 125, Mini 6, and SM 90. A SOL suppliers-users club has been created.

2. Sirius. The INRIA now considers that this distributed data base project has entered its final phase.

Here the effort will concentrate primarily on industrial spinoffs. Intertechnique will list in its catalogue the "Sirius Delta" SGBDR [Distributed Data Base System] whose prototype was developed in this project. This system, which integrates the different techniques developed, can be used to manage different types of data distributions, while protecting their confidentiality and the integrity of the distributed base in case of a breakdown or access by competitors.

3. Nadir. This project, conducted in cooperation with the DAII [expansion unknown], is studying the possibilities offered by satellite communications systems in general, and the possibilities of Telecom I in particular, with the development of the ANIS simulator.

4. Kayak. In cooperation with the ADI, this project is to develop the Mobile method for designing an office automation plan for businesses.

International Missions

International relations include an agreement with the University of Kyoto to conduct a colloquium in Japan this year.

There have been 329 missions abroad, of a total of 1,520, and 69 internationally-oriented conferences conducted as INRIA seminars.

Nationally-oriented conferences, totaling 243, have covered the establishment of clubs bringing together public and private organizations for developing modular software libraries: Modulef (finished elements), Modulopt (optimization), Modulad (data analysis), and Moduleco (economics).

Nine courses, with both a national and international focus, were given in 1981.

The publications center has recorded earnings for its publications of about 221,000 francs (18 percent sold abroad), an increase of 16 percent over sales in 1980.

The INRIA officials are now waiting to learn details about provisions of the new law on research and information about decisions made affecting electronics, so that their future can be programmed with precision. This information should be available within the next few weeks.

7679
CSO: 3102/302

POSSIBLE STRATEGIES FOR EXECUTING MICROELECTRONICS PLAN

Paris ELECTRONIQUE ACTUALITES in French 23 Apr 82 pp 1, 15

[Article by J. -P. Della Mussia]

[Text] For the last several weeks, certain members of the government responsible for problems of the electronics industry have officially declared that the five centers which manufacture integrated circuits that are considered as French (EFCIS, Thomson-CSF, RTC, Eurotechnique, and MHS) are too numerous, and unofficially stated that a recombination of the Thomson-EFCIS activities with those of Eurotechnique is inevitable. Many of the DIELI (Bureau of Electronics and Data Processing Industry) meetings have already considered this matter, but no decision will be taken before next July, especially since to our knowledge neither Eurotechnique nor National Semiconductor (NS) (49 percent of Eurotechnique) have yet been consulted about it. And while a reduction in the number of centers does appear desirable at first sight, the implementation of this project seems to be difficult; for EFCIS and Eurotechnique in particular, a joint administration could offer more drawbacks than advantages if NS continues to play along with its subsidiary, and especially if it gives it even more autonomy, as could be assumed from some of the statements of Dr Heikes, chief executive of NS in Europe.

But even before thinking about a reduction in the number of centers, it is appropriate to re-examine the reasons that have led to the formation of new centers as part of the first integrated circuits plan.

Why Five Centers?

Let us remember that before this first plan, three semiconductor companies located in France were receiving government support: Thomson-CSF, EFCIS, and RTC. Of the three, RTC is today the only one of world class in the narrow field of ECL. Thomson-CSF's bipolar integrated circuit division has a primarily European market in linear devices. EFCIS' production activity really began only two years ago; in 1981, its circuits turnover (except for studies) did not exceed 100 MF, which is a low figure compared to Intel's 2900 MF, for instance. It is out of the question for EFCIS to enter the market of high volume circuits, such as memories: Toshiba itself, for example, which this year will invest 500 MF in semiconductors (1981 turnover in this area was 4700 MF), has decided not to manufacture 64 Kbit RAM's!

It was to meet this French need for large standard MOS circuits, that the French creators of the first integrated circuit plan formed Eurotechnique.

The alliance with NS enabled this company to acquire a remarkable industrial know-how: last March, it produced one million chips with a yield which NS executives themselves pronounced slightly superior to their own.

The Matra Harris (MHS) operation was the last in the sequence. Its original slot, with a top of the line C-MOS orientation, appealed especially to DAII (International Industrial Affairs Directorate) executives. Added-on was the top of the line bipolar operation, whose goal was equally specific, and which was not supposed to upset the overall integrated circuits plan.

Finally, it became possible for MHS, the company thus created, to manufacture MOS circuits as an Intel second source. The question then arose as to whether three MOS centers were not too many for a country which represents only 4 percent of the world market. At the time, DIELI conducted a detailed study of the advantages and drawbacks of creating this third center: their finding was positive. Although this study has not been made public since then, we may suppose that this decision was essentially motivated by the fact that many users wanted to see Intel family microcomputer circuits manufactured on French soil, and that this formula could constitute a kind of guarantee for MOS mass production, in case the Eurotechnique operation was not successful. But the agreement with Intel is only a second-source agreement similar to the one between EFCIS and Motorola. The only two genuine, major unions have been those of NS and Saint-Gobain to form Eurotechnique, and of Harris and Matra to form MHS (the MHS-Intel union for Cimatel involves only circuit design, and not joint production with Intel).

Do Components or Systems Benefit?

The present situation is therefore the following: for linear devices, government support is going to Thomson-EFCIS, MHS investment in this field having been postponed.

For digital bipolars, support is going mostly to RTC's ECL families, but now also to Thomson-EFCIS.

The fact is that the Thomson group divisions have always required a French source for their 2990 digital bipolar family in particular, and the bipolar division of Thomson-CSF decided over one year ago to expand this activity. However, the basic vocations of RTC and Thomson-CSF appear to be different: RTC wants to perform as well as possible in its slot on a world scale, the bulk of its market being in the United States. Conversely, Thomson-CSF's orientations arise from French requirements.

RTC wants to derive its profits purely from semiconductor activities. For Thomson, it is conceivable that profits can be found in systems, by adapting components to the needs of the group or of other French customer firms. (Thomson-EFCIS however, has broader ambitions).

Great Differences Among MOS Companies

In MOS and C-MOS the three companies involved have three highly different natures.

Thomson-EFCIS started from an almost non-existent industrial level to reach world status; it has to conduct its own research and strengthen its international sales

network. The group benefits from a 100 percent French image, which means that Thomson-CSF, and French universities or industries first turn to it for implementing original system ideas. Thomson-EFCIS, which has a powerful design team, thus also receives a healthy influx of know-how. This influx is the company's only true strength in exportation development thanks to innovative circuits. But it will certainly not be able to be competitive for quite some time in mass producing standard circuits, simply as a matter of scale. We made some (wicked) comparative ten-year calculations assuming a flattering turnover growth (exclusively for production) of 50 percent per year at Thomson-EFCIS and 25 percent for Intel; this would result in a turnover of 5766 MF for the former and of 32,410 MF for the latter, or in a ratio grater than five between the two companies. This ratio would still force Thomson-EFCIS into a slot policy.

MHS on the other hand benefits both from Harris' research and development, and from an already existing commercial network: Harris in the United States (which will probably remain relatively small) and the joint MHS-Harris network in Europe (which is being bolstered).

In C-MOS moreover, MHS can immediately aspire to industrial mass production as a result of its alliance with Harris. Compared to EFCIS, the company thus has three trump cards from which it might derive an exponential growth throughout the firm's launching phase.

The company must nevertheless expand its research and development to eventually acquire a certain autonomy, and most importantly master the most advanced H-MOS technologies. On the negative side, for the time being MHS has a weaker potential for French innovation than EFCIS, but this drawback should be minimized as the strength of Cimatel, in particular, increases. Thus, in the long run, this company promises to attain world class for C-MOS, and specialist class for MOS, in full competition with EFCIS for the latter technology. We do not foresee that MHS, any more than EFCIS, will one day become competitive for mass produced MOS circuits.

The Case of Eurotechnique

Eurotechnique represents a rather exceptional venture. Unlike the other MOS companies, it wants to develop mass market circuits, which means that it must reach world class in order to be profitable. But it had four handicaps from the start: a non-existent sales network; a limited catalog; no circuit sales (unlike EFCIS and MHS) to generate turnover; and almost no research and development of its own (compared to other world class companies). Nevertheless, Eurotechnique has two advantages which have enabled it to adhere to its development plan. On one hand, NS is playing the game to the hilt: in particular, it has sent to Rousset its most up-to-date industrial know-how and all the masks that Eurotechnique wanted; on the other hand, the Eurotechnique team seems remarkably cohesive, efficient, and free to take initiative, since the St-Gobain partner is not an electronics component user with a vested interest in any particular orientiation on the part of the company. And finally, Eurotechnique has an additional circumstance in its favor: the leading United States semiconductor firms do not want to rub shoulders with Japanese companies among their distributors. Distributors for the Japanese thus readily accept Eurotechnique, whose MOS line is the same as that of NS, especially since

this company must be paid in francs, "a weak long-term currency." European distributors also welcome this European company, which spares them the 17 percent customs duties, and which constitutes a valuable local resource in case of lead-time extensions. In this way Eurotechnique achieves 65 percent of its turnover in exportations.

United But Not Necessarily by Love

Three MOS centers are too many in the eyes of the government, which feels obligated to support all three. From the users's standpoint however, the situation is very desirable: they have a French source for Intel circuits, for Motorola circuits, and for MOS memory circuits, as well as different services for custom circuits. But for this, these three centers would have to be long lived. Hence the government's idea of concentrating its efforts on only two companies.

Three plans for concentration are conceivable:

Join Thomson and MHS. This is the most rational solution for forming a "supercompany" with specialist status for MOS and world status for C-MOS; it is not a conceivable one at this point because of the rivalry that exists not only among upstream groups, but also among personnel and families of products.

Join Eurotechnique and MHS. This implies a four-way marriage (Matra, Harris, Intel, NS), which we find difficult to imagine but which would lead to a world class company both in MOS and N-MOS, since their catalogs match reasonably well. Faced with such a potential for innovation and industrial know-how, EFCIS would find it difficult to be anything else than a quasi-captive company for Thomson.

Join Eurotechnique and EFCIS. Their catalogs would be complementary but poorly matched: 8048 circuits for instance, would still be made by two centers in France, unless their fabrication was abandoned, with Eurotechnique becoming the mass production industrial branch for EFCIS products. As Eurotechnique warned : "Should this solution be adopted, the Rousset plant would be empty in one month." NS could not accept such a solution in any case, and if NS were to stop supplying the masks for new memories, which are the moving force for mass production know-how, Eurotechnique could no longer sustain world ambitions. For reasons that we have already given, it is out of the question for France alone to design mass production memories for a number of years to come. And what is more, it would be a pity to bring a dynamic team into the inevitably rather bureaucratic environment of the Thomson group.

The NS Trump Card

It would also be a pity to abandon an operation with NS, because it is the only chance to have on French soil a large N-MOS mass production, with a research and development program that is financially out of the reach of French companies. It is also true that while EFCIS and MHS have a well defined path with the weaknesses already indicated, Eurotechnique still has to develop a certain personality which in coming years will elicit interest in it the world over. This lack of image follows from inadequate research and development compared to world class companies, and from a small design center, even compared to that of EFCIS, or of Cimatel + MHS in the future, for instance.

NS has already said that it is ready to do even more. What could it contribute? Original research and development technology to lend some character to the company, and markets to justify manufacturing volume. This R&D could for instance cover EEPROM technology, which would allow the French company to design original products and in the future to begin volume production of standard EEPROM memories as replacements for EPROM's. Among others, the original products developed could be circuits to replace fusible-programmable TTL's (PAL, IFL, FPLA, and so on), thanks to a C-MOS structure programmable by means of non-volatile memory points.

NS could also bring markets to Eurotechnique, by opening its sales network to one or two product lines (ROM, RAM, microprocessors, or others), and by reducing the corresponding production in the United States (which is in fact what IBM does internally, depending on the manufacturing outputs of its various plants).

Collaborate or Concentrate?

As we can see, the union of companies appears very difficult even without taking into account the hostilities that currently exists among them. In fact, it would have the drawback of reducing overall French products sales abroad. Moreover, three companies are indeed too many if they depend primarily on the French market for their development. But the seven major Japanese semiconductor companies are aiming at the world market, and they succeed. Are there then other alternatives to avoid the scattering of the government's efforts? We can think of three.

Some research for the three companies could first of all be financed in joint public or quasi-public laboratories: semiconductor defects, self-testing, X-ray lithography resins, basic EEPROM technologies, and so on (in fact, this research could be conducted at least at a French-German level, if not at a European one).

In addition, a laboratory to evaluate the most advanced equipment could be established (also, why not, at a French-German level at first). This laboratory would systematically purchase all the advanced equipment being made in the world, and rent its installations for one or two weeks to Siemens, Thomson, Matra, and so on. Each of these companies could then select its equipment with some experience.

As a third possibility, production could be standardized to avoid having two French production lines manufacturing 2K x 8 static RAM's or 8048's, for instance. The upstream Matra or Thomson groups would not see eye to eye on this, but if they realy want to have a production line in their semiconductor division, why should they not pay the price of a captive production?

So far, the three semiconductor companies in question have kept--or almost--their promises as part of the first integrated circuits plan. In our opinion, it is too early to stop trusting one of them and break the pace. The accounting will come in 1986.

11,023
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ELECTRONICS

REPORT ON ELECTRONICS INDUSTRY MAKES RECOMMENDATIONS

Paris LE MONDE in French 14 May 82 p 35

[Unsigned article: "A Whole Which Can Only be Treated as a Whole"]

[Text] Jean-Pierre Chevenement, minister responsible for research and technology, and Mr Mexandeau, minister of mails and telecommunications, presented to the press on Wednesday, the report written by the Electronics Industry Task Force, chaired by Abel Farnoux.

The result of several months of joint work and study by representatives of all the ministries involved, the voluminous report of the Farnoux task force represents the first global study of the French electronics industry as a whole. We simply regret that the demands of national defense have led the Ministry of State, which headed the task force, to present only an expurgated version of the report to the press and the public.

The task force makes several proposals in matters of research budget, training, education, and relations among researchers and industrialists. Its major recommendation is more political. The task force in fact asks the government to assign the highest of priorities to the development of the electronics sector, to perceive its development in a global framework, and to install a coordinating structure responsible for "impelling and coordinating the activities of the sector's many participants."

The creation of this state secretariat for the electronics industry, advocated by the task force, depends on the assessment that the President and the government will make of the appropriateness of such a measure. Or in Chevenement's words: "This is a proposals report. It is now the government's job to draw conclusions."

In 1981, the electronics sector industries had a turnover of 96 billion francs. The nationalized groups provided 50 percent of this production, and the subsidiaries of foreign companies 30 percent (of which 13 percent from IBM, and 7 percent from Phillips). The trade balance of the sector as a whole was negative (1.5 billion francs) in 1981 due to deficits in consumer goods, computer, and office machine activities (-10.5 billion), which the positive results of professional electronics and telecommunications (+9 billion) could not counterbalance.

In order to re-establish the trade balance, create jobs, and place the French electronics industry on a par with the United States and Japan, the task force chaired by Mr Farnoux advocates a total therapy based on a few major orientations.

All areas of the electronics industry are "interdependent" in the eyes of the task force. The sector therefore constitutes "a single unit, and can only be treated globally."

"France must refuse to accept a slot policy. We must implement an overall sector recovery strategy, which first involves the development of our strong points: professional resources, and telecommunications-telematics. It is only by maintaining these two areas at the best world level...that we will be able to recover the situation of the weaker areas." Among these, "it would be appropriate to carry out a recovery effort in four areas: computer processing, office automation, consumer automation, and components."

The task force recommends an action coordinated at three levels: research, industry, and support policy.

Research

The money allocated to research-studies-development should be increased from 12 billion francs in 1980, to 20 billion (constant francs) in 1986. In order to "invest to obtain full value from each franc," the task force recommends the launching of national projects. "In the form of 'public interest groups', 'economic interest groups', or 'industrial development companies', these projects would join public or private research teams with industrialists and users, to launch new products involving technologic advances. The industrialization and marketing would remain the job of the industrial partners."

Fourteen national projects have already been counted, and Mr Chevenement has indicated that work teams will be immediately assigned to each of them.

Industry

Reminding us that the French domestic market is equal to only 6 percent of the world market, the task force estimates that "the French electronics industry cannot reach third place in the world unless it becomes strongly implanted on foreign markets."

The task force recommends the establishment of European cooperations, notably in the consumer area. "The stakes are such that the policy known as 'controlled delay', which consists of importing Japanese or American goods and then producing them under license, and which so far has failed in this domain, can no longer be attempted. France has sufficiently strong commercial and technical forces to negotiate an egalitarian cooperation with the Europeans. Technologically united, Europe can take the lead in new consumer products, whose impact on our civilization and culture will be considerable."

In the "support policies," the task force insists on the need to "launch a vigorous training program." If a considerable effort is not approved, there will be a shortage of 500,000 persons for the 1981-1990 period (75,000 engineers-researchers, 25,000 senior techicians, and more than 400,000 technical personnel, employees, and qualified workers) in case of a successful development of the electronics sector. For Mr Chevenement "new solutions must therefore be implemented, not only in terms of initial training, but of continuing training as well."

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BRIEFS

HONEYWELL SHARE OF CII-HB DOWN--The government and the American Honeywell group have just reached an agreement that cancels the leonine one concluded in 1977, which had created CII-HB. Henceforth, CII-HB (which does not have to keep the Honeywell name if it prefers not to) will be a French industrial company independent of any veto, responsible only to its shareholders, among which Compagnie des Machines Bull will hold more than 80 percent of the capital, and Honeywell the rest (19.9 percent exactly), but only as simple minority shareholder without veto rights. Honeywell has abandoned all its previous rights, that is, the quasi control of the company, in exchange for 150 million dollars. This "new" CII-HB will reach technical cooperation agreements with Honeywell on present and future product lines to be developed jointly. Other agreements will be reached conventionally for products which will be manufactureed mutually under license. In time, CII-HB will be able to make such agreements with other partners. And finally, at the commercial level, a third agreement stipulates that CII-HB and Honeywell, each in its present geographic sphere, will market as they wish the products of the partner so as to expand their catalog, it being understood that the sales organizations will continue to maintain their relationship. The Council of Ministers held on Wednesday, nominated Jacques Stern, currently president of the SESA Company for Computer Services, as president of CII-HB, with the latter leaving the tutelage of Saint-Gobain to come, like the other nationalized groups, directly under the wing of the Ministry of Industry. [Text] [Paris ELECTRONIQUE ACTUALITES in French 23 Apri 82 pp 1,7] 11,023

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ELECTRICITY PRODUCERS PLAN 10 MW WIND POWER PLANT

Amsterdam ELSEVIERS WEEKBLAD in Dutch 29 May 82 p 15

[Article by Fred Kappetijn]

[Excerpt] Wind Power Plant

The argument that the electricity people make such difficulties over wind power because they 'simply are against it' is slowly beginning to lose some of its force. Here and there, a power plant has itself put up a wind power generator to find out how it actually works. But these activities born out of curiosity have not been the end of it. To gain experience, the Cooperating Electricity Producers will, in the coming years, be building a wind power plant which will have a capacity of 10 megawatts (a modern coal-fired plant has a capacity of 600 megawatts). The wind power plant will consist of 40 turbines of 250 kilowatts, which will be adequate to provide 7,000 average Dutch families with power, assuming, at least, that the public network will pick up all peaks and dips in the supply.

The experimental wind power plant should provide an answer to the question whether wind power plants may be included in the public power network without jeopardizing the continuity of the power production or the cost price of 1 kilowatt-hour.

That is, of course, a most useful exercise, and it, therefore, is no accident either that the government had included the same plan in the National Wind Power Development Program No. 2. In this connection, some confusion and resentment arose when the Cooperating Electricity Producers came up with their plan, primarily because the Cooperating Electricity Producers had not consulted the Ministry of Economic Affairs, which finances the National Wind Power Development Program No. 2 and which has delegated its coordination to the Office of Energy Research Projects of the Dutch Energy Research Center at Petten. G. Piepers, engineer and project leader of the Office of Energy Research Projects, recently said in an interview with the engineering journal PT/AKTUEEL: "Among us, it is still a bit hard to swallow that a number of people who, a couple of years ago, were still certain that it was all nonsense, now, all of a sudden, find it such a fantastic solution. One asks oneself what is behind it. We have difficulty with this matter, certainly with the way in which it has been presented by the Cooperating Electricity Producers."

Financing

At the time, it was not clear whether the Cooperating Electricity Producers wanted a second wind power plant, or whether it was a question of the same plant. In retrospect, it appears to be a question of the same wind turbine plant. The costs of the plant have been estimated at 40 million guilders, but nobody will be surprised if the costs become considerably higher. Piepers said that he would not be too surprised if the plant eventually will turn out to cost twice as much. The contract for the construction will probably be awarded in 1983. Then they will also have to agree on the financing. Here, the strange problem arises that it is possible to quarrel who will be allowed to pay. The Cooperating Electricity Producers have in any case already declared that they will be ready to pay at least half the costs, and they even appear willing to take on the entire costs. It could not be nicer, one might say. Wrong. For if one does not contribute to the costs, one has got nothing to say, and that does not suit the Ministry of Economic Affairs. The pilot project constitutes part of the National Wind Power Research Program No. 2 and, therefore, must also comply with the program of requirements to be set up. Apart from this apparently unavoidable quibbling, the fact that everybody slowly seems to become involved with wind power is a sign that wind power will be given a role in the future energy supply of the Netherlands. But how significant will it be? Is all the excitement justified?

With its National Wind Power Development Program No. 2, which aims at the development of large and small wind power generators, the government aims at a wind power capacity in the year 2,000 of 2,000 megawatts via wind turbine plants and another 450 megawatts derived from 15,000 smaller wind power generators. If this target is reached, all these small and large wind turbines will be able to cover 5 percent of the present power consumption in our country, though not even 2 percent of the energy consumption.

That does not seem shocking, but there are, of course, no reasons either not to do it. It is, finally, a question of a clean and permanent energy source which is not influenced unfavorably by an increasing fuel price which may or may not be politically determined. Furthermore, the construction of wind power generators will mean a welcome industrial activity for the Netherlands which, thanks to a good domestic market, may provide a sizable export position. That is nice for the employment situation and the balance of payments.

To this comes, moreover, that the 2,500 MW wind power capacity which the government aims at is, indeed, not the maximum. Through the application of new technology, such as the mounting of small wings to the ends of the wings (tip vanes), a very considerable increase in the energy production is achieved, while, at the same time, the diameter of the wing remains the same. The 'inventor' of this concept, Theo van Holten, Ph.D., engineer, of the Technical University at Delft, has in mind an increase in capacity by a factor of 2.5, and if practice confirms the theory of the ejector effect, even by a factor of 8 to 10.

Cost Price

Even without this favorable prospect, wind power seems to have a bright future ahead of it. This is not due to its nice nature but to its economic attractiveness. Also here money has again prevailed over the ideal. In the brochure ENERGIE STRAKS [Energy Later] from the Association of Directors of Electricity Enterprises in the Netherlands, the authors expect the cost price of 1 kilowatt-hour of electricity generated from wind power to amount to 12.4 cents. This is somewhat more than coal (11.2 cents per kilowatt-hour) and less than oil and gas (14.8 cents per kilowatt-hour). A real breakthrough is expected as soon as wind power generators of 300 to 500 kilowatts have been developed and have been introduced on the market. These wind power generators will be appropriate for industrial use or for use in small wind power generating plants and have a favorable cost-benefit ratio.

Now that the natural gas prices for greenhouses in the Netherlands, at the request of the EC, have been sharply increased, wind power generators will, undoubtedly, become an attractive alternative as heat generators in this sector. As the name indicates, these wind power generators provide no electricity but heat, which is obtained through the conversion of mechanical energy via the friction of a water brake. The heat generators become profitable at a natural gas price of 36 cents per cubic meter. The price is now 35 cents and will, in the not too distant future, have increased to 40.5 cents per cubic meter.

In short, if we are not mistaken by the signs, wind power will have a bright future ahead of it.

7262
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FRG FINDS SWISS NUCLEAR DISTRICT HEATING CONCEPT APPLICABLE

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 18 Jun 82 p 7

[Text] Frankfurt, 17 Jun--In response to a question in the Bundestag the government clarified its attitude toward the experiences of Switzerland with nuclear district heat from the Goesgen nuclear power plant. In 1977 the possibilities for utilizing the heat in the cooling water from power plants was examined in Switzerland. In 1979 the Oltn heat link was studied, in which the cooling water from the Goesgen nuclear power plant was to be used. The Ministry for Research and Technology supported a similar study for the Speyer-Ludwigshafen-Worms area. In the low-temperature heat link, heat from the cooling water of the Biblis nuclear power plant was included for the purposes of the study.

In these studies, the principle was to use the effluent heat without tapping into the power plant, that is, without energy-heat coupling. Since the cooling water is not very warm, it is necessary to raise the temperature of this so-called "cold district heat" to a level sufficient to heat rooms by using heat pumps. To the government's knowledge, no such system to utilize nuclear district heating has even been built.

The Swiss Goesgen nuclear power plant, on the other hand, has been supplying process steam since 1979, which is obtained by tapping into the power plant process, to a nearby factory manufacturing cardboard boxes. According to the information available, high reliability with an availability of 97.4 percent was achieved in 1980-81. The government is of the opinion that the method used in Switzerland is applicable to conditions in Germany. The precondition is, however, that the utilization of effluent heat through an energy-heat link should be considered during the planning stage for the power plant. If it is necessary to tap into the generating process in an already completed power plant, considerable legal problems arise with respect to approval.

Nuclear district heating is already being used in the FRG. In the spring of 1972, process steam was supplied to a nearby industrial firm from the Lingen nuclear power plant. Since expectations concerning the availability of the nuclear power plant were not fulfilled, deliveries were halted again after a brief period. In contrast, the Nuclear Research Center in Karlsruhe has been reliably supplied with heat for heating purposes from the multipurpose experimental reactor for several years.

9581
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REVIEW OF FRG RESEARCH, DEVELOPMENT IN COAL CONVERSION

Rome RASSEGNA PETROLIFERA in Italian 23 Apr 82 pp 376-378

[Article: "Research on Coal Conversion in the FRG"]

[Text] The FRG, which imports more than 60 percent of its primary energy (almost entirely as oil and natural gas), has continually increased its public financing for research and development in the energy field. But whereas before the 1973 oil crisis the funds went almost exclusively to the nuclear sector, they subsequently began to go for subsidizing research in other energy areas also. From a ratic of 85/1 (DM 850 million as against 10 million) for aid to nuclear/nonnuclear energy in 1972, a ratio of 2/1 (DM 1.26 billion as against 616 million) was reached in 1980.

The greater part of the subsidies for nonnuclear energy is related to coal conversion. In view of the fact that it is desired to find energy sources alternative to oil and natural gas, a vast program of studies has been undertaken in the FRG for gasification and liquefaction of coal, as well as for advanced fuel systems for electric-power plants (and for other installations too) that are coal-fired.

The FRG has long experience in the field of gasification of coal. The research in this field was interrupted after World War II because of the importation of low-cost natural gas; but the sharp increases in the price of these energy sources and the anticipation of possible supply difficulties have led to a reconsideration of the coal-gasification technologies.

The objective is to reduce importations of natural gas through conversion of the abundant German coal reserves, with the use of nonpolluting processes. After 1973, pilot plants for various processes were built.

The new projects, based on the technology of the first-generation gasogenes (Winkler, Koppers-Totzek, Lurgi), are aimed at the following objectives: 1) extension of the range of coal types usable; 2) improvement of the yield from coal conversion; 3) increase in the quantity of coal treated and in production of gas per installation; 4) adherence to the quality standards for the gas produced and to the environmental standards.

Among the projects under way (some 10 of them), we cite the following by way of example. Ruhrkohle AG and Ruhrchemie AG jointly manage the 150-ton-per-day

pilot plant based on a license from Texaco. The plant, at Oberhausen-Holten, and ready as early as 1978, has been in operation for about 2 years. Several continuous tests have been carried out, for periods up to 500 hours. About 27,000 t of various types of coal have been converted into 50 million m^3 of synthetic gas, at a maximum rate of 12,000 m^3 per hour. The plant cost about DM 10 million.

Since 1974, Ruhrgas AG, Ruhrkohle AG and Steag AG, in cooperation with Lurgi Kohle and with Mineraloltechnik GmbH, have improved the traditional Lurgi process with development of the new "Ruhr 100" gasogene, which will be installed at Dorsten. The pilot plant, projected to treat a maximum of 170 t of coal per day, was completed in 1980.

The PNP [expansion unknown] Project--In order to improve exploitation of the coal reserves, a gasification process with low specific consumption of coal is being aimed at (in the "autothermal" gasification processes, the coal is used not only as raw material but also to generate the energy for the process). In this case, the energy is furnished as steam or process heat from a high-temperature gas-cooled nuclear reactor, which makes it possible to save from 30 percent to 40 percent on the coal. That is, the combination of coal and nuclear energy makes it possible to generate a secondary energy for the heat market and for production of chemical power supply.

The total development costs for the PNP project (which will be managed by Rheinische Braunkohlwerke AG and by Ruhrkohle AG) for the period from 1975 to 1984 are estimated at DM 1.3 billion. The FRG Ministry for Research & Technology and the Ministry of Economy of the Nordrhein-Westphalia region are furnishing a good part of the funds.

Winkler High-Temperature Process--The traditional Winkler process has proved that it functions well with highly reactive types of anthracite. With this experiment, Rheinische Braunkohlwere AG is extending the development of fluidized-bed technology. With the results from full-scale laboratory tests, the premises for the Frechen pilot plant A, completed in 1978, were created.

The experimental program at Frechen is concentrated on the points that differ from the usual Winkler process: 1) gasification under pressure up to 10 bars, so as to increase the unit capacity and improve the quality of the gas; 2) gasification at high temperatures (up to 1,100 °C) with addition of lime, limestone or dolomite in order to raise the fusion point of the ashes; 3) increasing the degree of conversion of the coal through recycling of coal not gasified.

We go on to consider the liquefaction of coal, the feasibility of which was demonstrated in Germany as early as the beginning of this century.

Bergius had studied the catalytic process, and Pott and Broche the noncatalytic one. The two methods (especially the former) still constitute the basis for the modern processes throughout the world.

The concepts of the technology of the big old plants (which in 1943 provided Germany with 4 million t of fuels from coal) again became the basis of the

FRG's new catalytic process at the beginning of the 1970's. At Bergbau-Forschung GmbH and Saarbergwerke AG, the experiments to establish the data for building new pilot plants (with the progress achieved elsewhere taken into account, of course) have been resumed.

The improvements aimed at in the catalytic process for liquefaction of coal are: 1) reduction of pressure and consumption of hydrogen; 2) increase in process yield so as to reduce consumption of coal; 3) better solid-liquid separation through distillation.

In 1977 it was decided to build a 200-ton-per-day pilot plant at Bottrop for catalytic hydrogenation of coal. A nearby cokery furnishes gas, water, steam and electricity. They hydrogen is taken from a gas pipeline. Ruhrkohle AG and Veba Oel AG were the principal collaborators in the design. The investments for the pilot plant total DM 200 million. The total expenditures of more than DM 400 million are in large part guaranteed by the Ministry of Economy of the Nordrhein-Westphalia region.

The Saarberg process for liquefaction of coal is also based on catalytic hydrogenation, and is aimed mainly at production of distillate oils. The process has been experimented with in numerous small-scale tests. Saarberg is now building a pilot plant that will treat 6 t of coal per day.

The project, with an overall cost of about DM 30 million, is sponsored by the FRG Ministry for Research & Technology and by the Ministry of Economy of the Saar.

The Germans are also participating in projects abroad, so as to have access to the most important technological refinements. Thus, Ruhrkohle is collaborating on the demonstration plant for the Solvent Refined Coal process (SRC II) of Gulf Oil, Exxon's Donor Solvent (EDS) pilot plant and (since as long ago as 1975) in the design work for the 6,000-ton-per-day coal-liquefaction plant to be built at Morgantown, West Virginia. The FRG's contribution to the costs will be 25 percent; another 25 percent will be provided by the Japanese government together with various industrial companies.

Coal should continue to be important in itself also--that is, apart from conversion of it into gases or liquids. Until about 25 years ago, anthracite furnished about 70 percent of energy in the FRG, while it currently covers less than 20 percent of the primary energy market. Efforts are now being concentrated for coal, used directly as a fuel, to regain a good part of its original market share.

In any case, people are well aware of the fact that this presupposes the development of new technologies that meet the following requirements: 1) high yield from the fuel; 2) low environmental pollution; 3) use of low-quality types of coal with high sulfur and ash content; 4) availability and reliability of systems (both small-scale and large-scale) for applications in industries and in electric-power plants.

The efforts of Ruhrkohle AG are aimed at development of the technology of the atmospheric fluidized bed for small units. The "Konig Ludwig" prototype plant,

with thermal capacity of 6 MW, is a small boiler for neighborhood heating as well as for process steam for industrial applications. For these purposes, a new boiler system with fluidized-bed combustion, capable of burning 24 t of coal per day, is being installed at Recklinghausen (in close collaboration with Thyssen Engineering GmbH and with Standardkessel). The cost of the project, including a 2-year experimentation period, will total about DM 7 million.

A second Ruhrkohle project, at Stadwerke Dusseldork in Flingern, is a fluidized-bed installation with thermal power of 35 MW for generation of electricity. It will burn 144 tons of coal per day and will produced 1,200 t of steam per day. It will cost about DM 17 million.

Saarbergwerke AG has developed an advanced type of electric-power plant and wants to build a 220-MW prototype of it at Voklingen in the Saar. Its essential characteristics are: 1) combined gas-turbine and steam cycle; 2) combination of fluidized-bed technology and of the traditional system of burning coal dust for low-value fuels; 3) integration of fume-scrubbing in the cooling tower and purification of the overall flow of exhaust gases; 4) considerable decrease in emissions of NO and SO_2; 5) increase in overall power-plant yield through incorporation of the gas turbine and with better recovery of the heat dispersion for purposes of neighborhood heating. Expected cost: DM 270 million.

The FRG, the United States and Great Britain are jointly developing the technology of fluidized-bed combustion in the IEA [International Electrical Association] plant at Grimethorpe.

Bergbau-Forschung and Vereinigte Kesselwerke AG recently formed Arbeitsgemeinschaft Wirbelschichtfeuerung for the purpose of developing pressurized-fluidized-bed combustion for the combined-cycle process for production of electricity.

Conversion of German coal into GNS [Synthetic Natural Gas] will be possible starting in 1985. The costs are estimated at DM 0.8 per m^3--more than double the cost of the natural gas currently contracted for 1985. With application of nuclear-process heat after 1990, a reduction in the cost of GNS is expected. In the FRG, the price of natural gas follows the price of oil. Synthetic gas from coal, estimated at DM 0.24 per m^3, should cost only 50 percent more than that from oil.

In the FRG, gasoline from big coal-conversion plants costs about double that from oil. Ten years ago, gasoline from coal cost 250 percent more than gasoline from oil. Something similar is true for all the other liquid products from coal. The German liquefaction program is aimed more toward the light oils than toward the heavy oils for electric-power plants, in view of the fact that there are very few electric-power plants and mineral oils in the FRG.

The price of coal in the FRG is not expected to be unpredictable like the price of OPEC oil. It is therefore considered that the design work for large coal-conversion plants will begin right away with the new national energy programs.

The first decisions could be for several gasification complexes of 1 million t of coal per year per unit and for liquefaction plants of 1.5 million t of coal per year.

Equally important is the program aimed at more rational burning of coal, especially in the electric-power plants, in view of the fact that this will remain the field of major coal consumption.

11267
CSO: 3102/305

BRIEFS

FUEL FROM TIRES, GARBAGE -- Two experimental plants in Great Britain -- The first one, located near Wolverhampton in the Midlands, is intended to produce light fuel, solid fuel and reprocessed steel from used tires. This unit, the cost of which is estimated at 6 million pounds sterling, co-financed by the British government, the European Community Development Fund and private capital, should be operational in 1984. From 50,000 tons of tires, it could produce 17,000 tons of light fuel, 17,000 tons of solid fuel similar to coke, shaped into briquettes, and 7,000 tons of steel, using a pyrolysis procedure developed by the Foster Wheeler Power Plant. Another experimental unit to start production shortly, will produce synthetic petroleum from household garbage. This experimental plant is the outcome of research conducted at the Institute of Science and Technology at the University of Manchester. About 10 tons of scraps are needed to produce 25 barrels of petroleum, the cost price of which would be $15 per barrel. The treatment, the cycle of which takes 10 minutes, consists of placing paper, vegetable scraps and cellulose products in a pressurized tank, together with hydrogen. This treatment thus reproduces at an accelerated rate the natural process of the formation of hydrocarbons. The product obtained has a good calorific value and contains neither sulfur nor nitrogen. [Text] [Paris SEMAINE DE L'ENERGIE in French 20 Apr 82 p 11]
8463

CSO: 3102/295

FRENCH FIRM DEVELOPS HIGH-SPEED ELECTROLYSIS

Paris INDUSTRIES & TECHNIQUES in French 20 May 82 pp 155-156

[Article by Christian Guyard]

[Text] Metal plate deposited 60 times faster with no deterioration in quality with electrolyte moving at 2 kilometers per minute.

People have been electroplating for a long time. In close to a century, now, they have of course made considerable progress in quality, but in all that time the speed of the process has been increased by a scant four or five time. Using an electrolysis current with an anodic phase triples the speed and improves quality, but it also overloads the generators. On the other side of the equation, price rises are forcing electroplaters to deposit plating metals only where they are absolutely required. A purely metallurgical process, known as colaminage, coats tapes with gold or nickel tracks. It is, however, confined to thickness greater than 5 microns. Sometimes the specification calls for the plating to be laid down in perfect concentricity around a bar. For this purpose, there are two very complicated machines which deposit a scant 2.5 microns per minute. In cases where you must quickly recoat very large pieces on the site, ways must be found to shorten down-time and avoid disassembly, which is always costly. The "buffer" method provides a solution, but its performance is very low. Therefore one is constantly running into problems with costs dimensional precision.

The Ceres Company in Romainville has developed a high-speed electrolysis system it calls Certec, which boosts plating speeds by a factor of 20 to 60, depending on the metal. The metallic coating is extremely regular, even on cylindrical surfaces. On tapes, it can lay a thickness of a single micron of gold or 5 microns of nickel. Extremely well suited to the continuous "roll-by" process for rell- or spool-wound products, the process lends itself well to very thick point-plating. It uses simple electrolytes and direct current. The generator thus requires only a modest investment.

Expressions of interest have been forthcoming from the most disparate industries, including microelectronics, ,etal processing, pre-extrusion coating, and anti-corrosion. All of them will find the new process will eneble them to cut fabrication time and costs while maintaining high quality.

Tapes: 10 to 20 mm/min.

Deposit speed is limited, for a given quantity, by the polarization of concentration, or, in other words, the impoverishment of the solution around the cathode. Here, though, the thickness of the boundary layer is reduced by the very high speed (anywhere from 100 mm per minute to 2 km/minute) at which the electrolyte circulates, which sets up a turbulent hydrodynamic system. Introducing inert solid particles, such as glass marbles, further increases the turbulence of the layer.

In order to make the transit from this principle to industrial application, its discoverers had to define the geometry of the electrolytic cell and calculate its dimensions as a function of the form of the substratum and the area to be treated. For one thing, the distance between electrodes could not exceed a few millimeters. The simplest example is that of a round wire and a concentric cell. In roll-by machines, the problem of electrical contact with the line is solved by a second cell, inversely polarized, mounted in series. This "liquid" contact will stand the high tensions required. A fixed mask governs the width of the metal deposited on the tapes. The line moves at a rate of 10 to 20 meters per minuts. Circulation is handled by an oscillating piston pump which puts our several cubic meters per hour under 5 to 10 bars of pressure. Its closed-circuit operation prevents any pollution of the electrolyte and of the environment immediately surrounding the machine. The machine uses the standard plating salts -- sulphates, pyrophosphates.... Use of the process for on-site coatings was been studied in collaboration with the Atomic Energy Commission. In 20 minutes, a mobile unit laid a 30-micron stripe of nickel 5 centimeters wide on a flange 6 meters in diameter. A device for plating 2 square meters per hour is now in the design stages. Still another project involves a multi-use machine for cutting, polishing, and plating. Shifting from one requirement to another will involve only a change of electrolyte and polarization.

6182

CSO: 3102/365

MICROGRAVITY RESEARCH

Paris AFP SCIENCES in French 27 May 82 pp 15-16

[Text] ESA's announced and recently approved microgravity research program (see AFP-SCIENCES nº 293, 21 Jan 82, pp 24-25) got off the ground with successful launches of two probe rockets conducted at Esrange, the Swedish launching facility at Kiruna in that country's far north.

The new program calls for the agency's participation in the microgravity research program begun with probe launches by Germany (Texus) and Sweden, and the ESA has its stipulated share of the payloads launched with those first two shots (Texus 5, on 29 April, and Texus 6, on 8 May 1982). The six scientific experiments picked by the agency, all of them in the realm of materials sciences, were supplied by scientific institutions in Belgium (1), France (2), Germany (2). and the Netherlands (1). One technical experiment was added to the payload: an acoustical blender for producing homogeneous metallic samples under micro-gravity conditions.

The user community will get further access to flights aboard probe rockets under the program in 1983, 1984, and 1985.

Probe rockets currently used in Europe make it possible to achieve conditions of microgravity (1/10,000th of earth's gravity) for periods of time on the order of 6 minutes, and they can be used by research teams in developing experiments which will pave the way for later missions aboard the Spacelab and the European-built retrievable instrument-carrier (EURECA). There is no doubt that the scientific results of these two launches, now undergoing assessment, will confirm the value of probe rockets for research in the field of materials sciences under conditions of weightlessness.

6182

CSO: 3102/365

SCIENCE POLICY

FRENCH PLAN REFORM ON MAJOR RESEARCH ORGANIZATIONS

Paris LES ECHOS in French 18 May 82 p 5

[Article by J.M.: "Reform of the CNRS, the AEC, the INSERM as Early as in the Beginning of Summer"]

[Text] Even before the law on the orientation and programming of research has been enacted, Jean-Pierre Chevenement is already tackling the next stage: the reform of the large research organizations. The consultations are in progress, the implementation decrees could be issued as early as in the beginning of summer. On the menu: the CNRS [National Center for Scientific Research] and the INSERM [National Institute of Health and Medical Research], but also the AEC. As well as the organizations for cooperation with developing countries, which will be examined at a future Council of Ministers meeting.

These reforms will be based on four major principles:

. Decentralized management. Thus, the various departments of the CNRS will see their autonomy strengthened. And within the AEC, four institutes will be established: basic research, technological research and development, nuclear security and protection, and military applications.

. Regionalization. The CNRS will appoint regional correspondents who will work with the regional representatives of the Ministry of Research. The responsibilities of the regional AEC centers will be increased.

. Democratization and opening up. As foreseen, personnel representatives will sit on the boards of directors of research organizations. Personalities from the economic world and from labor will also be present.

. New missions: development, scientific and technical information, and training. Within the CNRS, a directorate for development and a directorate for scientific information will be set up.

This reform will not necessarily entail major changes at the top of the research organizations. The two-headed structure of the CNRS -- a president and a general manager --, which has so often been criticized, may not be abandoned. "Everything depends on the people involved," noted Jean-Pierre Chevenement. The authority of the president and of the general manager will simply be clarified. On the other hand, some redistribution of committees will take place within the CNRS, and specifically interdisciplinary committees will be set up.

For the AEC, one of the elements of the reform lies in the establishment of a board of directors, in addition to the management committee. Will the various measures provided for that organization meet with some hostility on the part of the hierarchy and the personnel as well as with differences within the government? Jean-Pierre Chevenement denied it -- the government knows what it is doing -- and announced the reform of the AEC "as quickly as possible."

8463
CSO: 3102/295

PRELIMINARY WORK TO BEGIN ON MAGNETIC TRAIN FOR BERLIN

West Berlin DER TAGESSPIEGEL in German 19 Jun 82 p 10

> [Text] Probably by the end of 1983, between the Gleisdreieck subway station and the Potsdamer Platz, a completely new local transit system will be in experimental operation with the magnetic train. After much arguing back and forth, the government has given the "green light" for the financing of the magnetic train tests in Berlin with a "declaration of intent" and the "go-ahead for the preparatory planning work," as Senator for Economics and Finance Pieroth stated to the press yesterday. In his communication, the Minister for Research had declared his intention of supporting the operational testing of magnetic train technology in Berlin with a federal subsidy of 75 percent of the total cost, in the amount of about DM 50 million, as long as the parliament in Bonn agreed.

Both Senator Pieroth and a representative of the minister were in agreement, stressing that one could assume that the budget committee of the Bundestag would finally approve the funds. On the basis of the "declaration of intent" from Bonn, the preliminary work for the planned magnetic train operation can begin immediately.

As has been reported on several occasions, in the first stage the closed down subway line from Gleisdreieck will be converted for a distance of 600 meters in the direction of the Potsdamer Platz for testing and technical certification of the new technology at a total cost of DM 19.5 million. Then the practical operating ability of the magnetic train will be demonstrated in a second phase, with an extension into the cultural quarter on the Kemperplatz, for which DM 30.5 million have been set aside.

Pieroth described the decision in Bonn as a joint victory for all parties, which would open the way for a reference facility "which is unique in the world." The magnetic train would contribute substantially to projecting the image of Berlin as a center for research and development.

The magnetic train system is being offered by AEG-Telefunken and developed and built by the Berlin Office for Rail and Road Transport Technology. As Director Milz of AEG-Telefunken explained, almost all the investment for the magnetic train project would take place in Berlin. This would safeguard several hundred jobs.

AEG-Telefunken and Senator Pieroth see the crucial long-term effect in the orders that are expected to follow and the "sale of magnetic trains throughout the world." Large cities in developing countries in particular would have a need for this new local transit system, which was much more cost-effective to manufacture in comparison with traditional technologies. If testing on the reference facility proceeds positively, some thought--so it is said--is being given to the possibility of integrating the magnetic train system into the Berlin subway and intra-urban network, or, alternatively, of converting the modernized intra-urban lines to the magnetic train.

Bonn has been supporting the magnetic train system's development for 7 years. In the meantime, 200,000 kms have been covered on a test facility in Braunschweig on the new magnetic track. The representative from Bonn said that the technology as such was tested and safe. What was needed now was practical operational testing, carrying passengers regularly, which is now planned in Berlin.

Yesterday, the "inventor" of the magnetic train, Goetz Heidelberg, once again explained the design principles and the advantages of the magnetic train compared with the technologies employed until now. The magnetic train has neither an electric motor nor a chassis in the traditional sense, but is carried and propelled by a linear motor on moving magnetic field by means of permanent magnets, which are distributed along the entire line. Wheels and the complicated subframe of the subway or intra-urban railroad cars used until now are dispensed with.

The weight of the magnetic train cars was about one-half less than that of conventional electric self-propelled units for rail traffic. According to figures from AEG-Telefunken and Heidelberg, if the magnetic train is carried on an elevated rail line, construction costs and material expenses are reduced to one-third of those for comparable trains using rails. As a result, energy consumption is also considerably lower. Altogether, investment and operating costs for the fully automated magnetic train would be "lower than those of all other rail-guided local transporation systems."

SPD: First a Sensible Intra-Urban Plan

The spokesman for transportation policy of the SPD fraction in the house of delegates, Staffelt, explained in a statement concerning the magnetic train project that this technology could not be of primary interest for Berlin at the present time. Magnetic train technology was mainly to be considered where new lines were being built. But this was not anticipated in the city in this century. Rather, it was a matter of expanding and/or modernizing existing lines. The Social Democrats would, therefore, not vote for the financial obligations of Berlin needed to carry out the magnetic train tests as long as a sensible, fully financed plan for the intra-urban railroad was lacking. Staffelt concluded his statement by saying: "If we are to have an M-train, then let it be Maerklin."

9581
CSO: 3102/355

FRENCH SEE POSSIBLE DECREASE IN GERMAN AIRBUS PARTICIPATION

Paris AVIATION MAGAZINE INTERNATIONAL in French 15 May 82 p 47

[Article: "Deutsche Airbus Persevering"]

[Text] A voluntarist partner from the very beginning in Airbus Industrie, the FRG is fulfilling a leading role in the development, the production and the financing of the different members of the European family of airliners. In this context, the partnership remains totally intact even though, on the other side of the Rhine, projections as to the future are sometimes characterized by a much greater measure of caution than those of Paris or London. True, the Bonn authorities are being compelled by circumstances to tot up...

At the risk of seeming repetitious, the fact warrants underscoring that Germany has never shown the least hesitancy as to the soundness of the Airbus operation, considered in its broadest and most ambitious sense. And, when it comes to the question of enlarging the present family, Deutsche Airbus officials hasten to point out that all the ideas under consideration have merit, and that a prejudgement in favor of one or the other is not involved in its view, but that prior consideration should be given to consolidating the successes already achieved.

Clearly then, and fully understandably, there is no point in seeking in Bonn or in Munich the key to the decisions that will have to be taken sooner or later as between: Launching of the 150-seater, namely, the A-320, or of the TA-11 long-range liner (which Lufthansa continues to call for), or of the TA-9 or TA-12, both the latter being "stretched" versions of the existing airframe, the first of these providing more carrying capacity and the second longer cruising ranges. On the other hand, as in the case of its military commitments, the FRG, compelled to recognize that its budgetary resources are not the same as they were a few years ago, is adding up its figures.

Furthermore, its structures being different from those of France and Great Britain, and debate more public and assisted, not necessarily helpfully, by a very investigative press that does not hesitate to line up figures that perhaps were not meant to go past the doors of this or that ministry, the accounting is being done entirely by way of public opinion.

What does this mean? That based on the figures already published officially, and in part on those being leaked to receptive columns, a better idea can be had of the magnitude of the German effort to participate in Europe's reconquest of an appreciable share of the world market for airliners. And, as will be seen, the financial orders of magnitude are starting to be impressive.

The German aeronautical industry as such, essentially MBB [Messerschmitt-Boelkow-Blohm] and VFW [United Aeronautical Company], now merged, has benefited from reimbursable governmental aids of 1.35 billion DM for the A-300 and 1 billion DM for the A-310, these amounts having been advanced to help the industry finance its share of the development of the two planes. For the A-300 alone, however, the industry itself has put up 10 percent of the total cost. These initial budgetary loans are, in principle, reimbursable as planes are delivered to the airline companies, but in actual fact the reimbursements are presently being deferred, which is a form of supplementary aid.

On the other hand, to finance the mass production of these planes, the industry has contracted loans totaling 2.85 billion DM, with backing from the authorities. Lastly, the government has provided substantial budgetary aid to facilitate the financing of sales. No figure for this latter aid has been given out officially, but according to the daily DIE WELT, it amounts to 2.04 billion DM. According to this same source, the total of the industry's investments has now gone beyond 2.85 billion DM, having now reached 4.1 billion. This would place the total investment as of now at over 8 billion DM.

Considering that this is a very long-term and burdensome operation, the profitability threshold of which is therefore distant in time, one can well understand the questions being put in Bonn with respect to the possible launching of another Airbus program. Not as regards its credibility, but rather because of the austerity that has befallen the budgets of the different departments and the need to be sure of the soundness of any additional investments.

Germany's participation in a third Airbus Industrie program can thus reasonably be expected to be of the order of not more than 20 percent, instead of the previously anticipated 37.5 percent. If in Bonn's view, aeronautics were to warrant a less conditioned priority, perhaps things would go differently. But this becomes an entirely different question.

Without even taking into account the multiplying effect that economists sometimes wield rather freely, it is nevertheless well to also recall that the Airbus-300 and -310 programs currently represent 18,000 jobs in the German aeronautics industry, 11,000 of which are strictly production-type jobs, in several divisions of MBB, of course, but also among many suppliers and subcontractors, including Dornier.

In sum, in confirming its commitments under the current programs, in participating in the expenses accruing to the A-300-600 version, and in releasing recently further funds to finance sales, the German government has, in its own way confirmed itself as a steadfast and resolute partner. Which does not prevent it from recognizing its own limitations.

9238
CSO: 3102/298

TELEMETRY DATA ON DO 228 CRASH REVIEWED

Gelsenkirchen AEROKURIER in German May 82 pp 516,520

[Article by Ralf Nolting: "What Happened, Now What? — First Findings on Accident"]

[Text] "We find it difficult to understand why they went so far." So summarized chief test pilot Dieter Thomas the unanswered questions of Dornier and the Federal Aviation Office [LBA] following the crash of the Do 228-100 prototype on 26 March of this year in the vicinity of Aichach in Upper Bavaria. Dornier board spokesman Dr. Bernhard Schmidt was more precise in speaking to the AEROKURIER: "We cannot build aircraft for such extreme situations." Both statements were made a few days after the accident. By this time the circumstances of the accident had already been largely clarified since all important flight data had been transmitted to a ground telemetry station before the aircraft broke up at about 400 meters.

Following the first flight on 28 March 1981, the Do 228-100 prototype had been tested in 182 flights for a total of 207 hours. The somewhat larger "Dash 200" reached 180 hours in 145 flights. Thus the total test time of both prototypes had reached 410 hours on the eve of the crash. The first series aircraft was delivered in early March to the Norwegian regional carrier Norving, this just four short months after the Do 228-100 had received type approval from the Federal Aviation Office. The last test flights which came to a temporary end with the 26 March crash were being made to gain the airworthiness certificate of the Civil Aviation Authority (CAA) of Great Britain. A team of eight CAA experts had come to the Dornier plant airfield at Oberpfaffenhofen for this purpose. The members of the "British LBA" initially received a three-day briefing on the previous certification program of the Do 228. The attention of the British was drawn in particular to the so-called "Longitudinal Control System."

On the unlucky day the aircraft with the registration D-IFNS had already made four flights. Dornier chief test pilot Dieter Thomas demonstrated to the British stall behavior in various configurations and single-engine climbs among other things. During the fifth flight on this day Dieter Beckmann, Dornier Do 228 project pilot, was the pilot in command. Also on board were CAA test pilot Alan Grear in the left seat and CAA flight test engineer David Morgan. Alan Grear had been with the British aviation authorities for four years. He had previously flown Tornado, Hawk, Phantom and Jaguar aircraft with the Royal Air Force [RAF] and was licensed

for the Airbus A300 and Boeing 747. Flight test engineer Morgan had, like Grear, served with the RAF before joining the CAA.

This crew took off at 1728 local time under good weather conditions for a second test flight. Takeoff weight was 4,900 kg or 800 kg less than the maximum of 5,700. The CG was 17 percent forward, which corresponded to maximum nose heaviness. Everything that happened to D-IFNS in the subsequent period of almost an hour was radioed to the telemetry station in Oberpfaffenhofen in a total of 134 measuring data.

Six points of the planned test program were accomplished routinely. These included stall tests, trim changes using the flaps, go-arounds and missed approaches. Point 7 of this test series dealt with the "longtitudinal control system" so highly regarded by the British. This also included trimming in pitch. It is configured on this aircraft — as is common worldwide — as a so-called "fail positive system." In precise terms the problem was to simulate what would happen if the aircraft were on autopilot and trim suddenly "ran away" in the direction of nose-heavy. The test program stated this to be roughly "assessment of longitudinal handling using elevator against nose-down stabilizer at 180 kts." It must be noted here that the Do 228 — like many aircraft of this category — is trimmed with the stabilization surface of the horizontal tail assembly.

At an altitude of 6,500 ft and an indicated speed of 180 kts, Alan Grear pressed the trim button on the left side of the control wheel in the direction "nose down." As the recordings subsequently indicated, he held the button down for exactly 3.6 seconds, resulting in a negative angle of 2.6 degrees on the horizontal stabilizer. To counter nose-heaviness, he pulled, with a continually increasing stick force, up to a value of 45 kg. For comparison, Dornier pilots have gone up to 55 kg in tests of this type. Upon reaching 45 kg stick force, the British test pilot set trim back to neutral.

It must be noted here that Grear had, by manually trimming, already simulated an autopilot runaway of 10 seconds. Given an autopilot defect, he would thus have had 10 seconds until the horizontal stabilizer reached a negative angle of 2.6 degrees. But appropriate regulations allow a maximum of 3 seconds of runaway time. In this time the aircraft must be capable of being returned to normal position. Grear thus exceeded the normal tolerances by a factor of 2.5 during this first trim test.

A couple of seconds later he again pressed the trim button forward. And not "progressively," in small steps as customary. Grear trimmed "continuously" in one motion. This time for 7 seconds. The telemetry system registered a 4.6 degree "nose down" position of the horizontal stabilizer. The stick force was measured at 60 kp. And thus the apparently strong-armed test pilot still was able to maintain the flight level. At this moment he asked the flight engineer "Are we in a full nose-down position?" When David Morgan answered in the negative, Grear again applied nose-down trim for three brief periods. After being again questioned, the engineer confirmed "full down." As measured on the ground, this means 5 degrees. But at the moment the telemetry system was already registering 5.5 degrees minus on the horizontal stabilizer. Possibly due to aerodynamic deformation

caused by the now rapidly increasing speed. Now the nose of D-IFNS can no longer be held above the horizon even though Grear is pulling 90 kg on the column.

Only now does he yell to his German colleague Beckmann "Come in the stick!" As Beckmann, who apparently has no idea of the force that Grear is already exerting, begins to pull, the nose is already pointing 30 degrees down. Both are now pulling on their columns with 150 kg. Beckmann commands "trim up" and Grear describes his effort as "trimming." But, as the recordings later show, the horizontal stabilizer at this moment does not move a single millimeter in the direction of neutral. As the nose reaches 34 degrees below the horizon, Beckmann further reduces engine power to 60 percent. At about this moment the airspeed indicator passes the 250-knot mark. At the same time the rudder comes off and shortly afterward the aircraft breaks up. At exactly 302 kts indicated speed, 50 degrees nose-down position and a load factor of minus 3 g. It is 1822.

Three days later on the morning of 29 March and after the first evaluation of the telemetry data, the investigation department of the Federal Aviation Office determines "...based on our present knowledge, we see no necessity to limit Do 228-100 operations." The task of the continuing investigation now is to find out why the trim motor did not start when Dieter Beckmann yelled "trim up!" to his British colleague and the latter confirmed that he was trimming. Was it a trim motor technical defect? Or could the motor simply not start at such high aerodynamic loads? And this leads to the second, obviously important question. That of exactly why the aircraft was maneuvered into such an extreme situation. After all, competent regulations permitted only 3 seconds of runaway time (in the autopilot system). It is thus assumed that the pilot will take action after 3 seconds at the latest. But the British pilot waited seven times as long. He let the trim — transmitted to autopilot operation — alone for a total of 22 seconds. And also why did the Britisher first wait until he had to pull 90 kg before he asked for help? To cite regulations again, they prescribe a maximum stick pull of 22 kg.

No matter what the final accident investigation result may be, Dornier foresees "no great delays" in Do 228-100 flight testing. This is largely due to a rather unique act of assistance in aviation. Norving of Kirkenes, the first Do 228 customer, spontaneously made its first series aircraft available for continuation of the test program. The regional airline noted in this regard "It goes without saying that, by making our Do 228-100 available to the manufacturer, we are contributing to the continuation of the test program interrupted by this tragic loss. We also today have no doubts about the technical reliability of this aircraft."

As early as 5 April Dornier was able to demonstrate the Norving aircraft in Egypt. The potential customers there are Pyramid Airlines and Egypt Air. Following the demonstrations over the pyramids, the aircraft "demoted" from a series version to a prototype received the necessary test equipment at Oberpfaffenhof. The regular test program was continued at the end of May.

The certification program for the 200 series was not effected by the 26 April accident. The required flights for Federal Aviation Office certification are planned for May with those for British certification to follow. Overall only six

aircraft will be delivered this year instead of the planned seven of both versions. Also, the first 100 customers require only Federal Aviation Office certification.

Overall at present there are 27 firm orders, 51 options and 6 so-called "letters of intent" for both versions of the Do 228.

Seven aircraft will be delivered this year, 21 next year and 27 in 1984. An interesting note is that no sales activities have yet been undertaken in North America. But negotiations have been made with a total of 136 potential customers. And this in Africa, a land where Dornier has traditionally been well represented, in Asia, Australia and Europe. At present all negotiations are dealing only with the passenger version of the 228. Dornier now lists the price of the 100 version at DM 3.4 million and that of the 200 at DM 3.8 million.

8373
CSO: 3102/340

A310 FIRST FLIGHT PICTURE-PERFECT REPORTS SAY

Gelsenkirchen AEROKURIER in German May 82 pp 522,523,526

[Article: "Airbus A310: Picture-Perfect First Flight"]

[Text] A great day for the small Airbus. On Sunday, 3 April 1982, in Toulouse the small A310 Airbus made its maiden flight. With Lufthansa colors on the left side and those of Swissair on the right, the A310 lifted off at exactly 0633 GMT only to disappear a few moments later in the still but rather misty morning air. The first flight lasted exactly 3 hours and 15 minutes.

The A310 equipped with the new FFCC [Forward Facing Crew Concept] two-man cockpit was flown by Bernard Ziegler and Pierre Baud. Flight test engineers Guenter Scherer, Gerard Guyot and Jean-Pierre Flamant shared the monitoring of the numerous flight test systems and onboard measuring facilities during the maiden flight. In a first statement after landing, Bernard Ziegler declared "All goals established for the A310 first flight were achieved. It was really a flight without problems and without any surprises since the little bird flies just as pleasantly as its older brother, the A300."

During the maiden flight the A310 was tested over an extensive range from slow flight at 1.1 Vs to cruise at up to Mach 0.75. An altitude of 31,000 ft (9,455m) was reached during the first flight. After the landing, Flight Division President Pierre Baud declared "During the first flight all systems worked perfectly and completely accomplished their mission, that of decreasing crew workload in regard to more economical flight operations." Pierre Baud continued "There is no doubt that this is the result of our previous preparation in the simulator and in flying the similar A300."

The first flight of the A310 was also the start of one of the largest and most ambitious, particularly in terms of deadlines, flight test programs to ever be conducted in Europe. A total of five Airbus A310 aircraft will be put through flight testing in coming months in order to accomplish the tight schedule plan, which calls for A310 type certification including Category II approaches as early as March 1983. The A310 is to begin scheduled service the same month.

Although the first A310 has Lufthansa colors, the airline will never get this special aircraft. Instead of the Lufthansa version with General Electric CF6-80A engines, the A310 just flown has Pratt & Whitney JT9D-7R4 engines as ordered by

Swissair. The second A310 to go into flight test also has Pratt & Whitney engines since it is earmarked for Swissair. The third A310 for flight test will be the first with the General Electric CF6-80A engines and likewise the first Lufthansa aircraft.

Airbus Industrie planning calls for the three aircraft named above to be used for the company flight test program. Two additional A310 aircraft, one Lufthansa and one Swissair version, will be included in the flight test program for route testing and determination of exact performance parameters.

The Airbus program has entered a new phase with the beginning of A310 flight testing. The requirement to develop an aircraft family which is so important to the future of the Airbus program is thus a large step closer to reality. But it must be noted that the A300 is already available in a variety of subversions and thus already seems adequate today to cover the requirements catalog of different airlines. It can indeed be said that the success hitherto of the Airbus is due in large part to the versatility of the available A300 versions.

Despite the great external similarities of the two basic A300 and A310 types, there is no doubt that the A310 is, technologically speaking, a great step forward and, in terms of operational characteristics, is virtually a new aircraft.

Once again the most important technical characteristics of the A310 in brief:
- wings: the A310 has a transsonic wing with a new airfoil which promises clearly reduced resistance particularly during cruise flight and thus fuel savings. As compared with the A300, induced resistance is reduced by a greater aspect ratio. Simplified flap systems and control elements decrease manufacturing and maintenance costs.
- cockpit: much has already been written about the modern cockpit philosophy of the A310. This A310 concept known as FFCC is based on the widest possible replacement of mechanical or electromechanical instruments with modern, computer-controlled video display systems. The A310 also has an integrated flight control and flight management system that not only reduces cockpit crew workload but primarily contributes to the A310 being always able to make economically optimum flights.
- materials: Airbus Industrie sees a valuable contribution to reducing energy consumption primarily in the successful efforts to decrease the gross tare weight of the A310. This was achieved by comprehensive use of modern compound materials, particularly in the so-called secondary structure.
- engines: aerodynamic refinements on the A310 are complemented by corresponding improvements in the engine area. As compared with the Airbus A300 CF6-50C engines which are already considered economical, the General Electric CF6-80A3 engines for the A310 will probably have a fuel consumption 6 percent better. Another advantage of these engines is the further reduced noise and exhaust gas emission.
- flight comfort: passengers will also profit from the introduction of the A310. For one thing, the "small" Airbus will have wide-body comfort on routes hitherto flown only with the Boeing 727, DC-9 or similar aircraft with standard fuselage section. For another, as compared with the A300, there will be a number of valuable minor improvements such as greater stowage for hand luggage.
- two-man cockpit: the FFCC has been reported here often and in detail. As is known, this new cockpit concept caused disagreements between pilots' associations

and airlines. A non-flier looking at the A310 two-man cockpit might be very disappointed. Instead of the usual cockpit full of instruments, scales and controls, that of the A310 appears simple, clear and easily grasped. Many functions previously done by mechanical instruments are now electronically transmitted to the crew on a video scope.

Airbus Industrie, Lufthansa and Swissair cooperated closely in defining the A310. This aircraft thus originated from a joint attempt to cover airline requirements as fully as possible with the technological possibilities of modern aircraft building.

On 2 April 1979 the historical signatures were placed on the Lufthansa order. Dr. Herbert Culmann and Reinhardt Abraham signed for Lufthansa. The contract provides for not less than 25 firm orders of the A310 aircraft and options for another 25. Deliveries are to begin in March 1983 with the contract calling for a total of eight A310 aircraft to be delivered to Lufthansa by February 1984.

The total contract value exceeds DM 1.5 billion. In the 1982 to 1984 period Lufthansa will invest almost DM 20 million in initial equipping with tools and fixtures for the A310. To this must be added an additional DM 70 million for the new maintenance center in Frankfurt which is also being built specially for the introduction of the A310. The investment for A310 flight simulator is said to be DM 20 million.

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BRIEFS

NONASBESTOS AUTOMOBILE BRAKES — The majority of German automobile manufacturers are presently investigating the use of nonasbestos brake linings. Only the Volkswagenwerk AG of Wolfsburg and Audi/NSU Auto Union AG of Ingolstadt are using these semimetallic linings on a series basis in various vehicle types such as Golf, Passat or Audi 80. According to a VW spokesman, however, this applies only to disc brakes while drum brakes are still being equipped with conventional brake linings. The Ford-Werke AG, Adam Opel AG of Ruesselheim and Daimler-Benz AG of Stuttgart are all making large-scale tests. They all state that they may possibly equip new models with nonasbestos brake linings on a series basis. [Text] [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 11 Jun 82 p 7] 8373

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